Space Weather Technical Forecast

Issued on Friday, 26 July 2024 at 01:17 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Slight Chance of G1/Minor Storms Days 1 and 2 (26-27 Jul). Chance of R1 Radio Blackouts throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity was Moderate in the last 24 hours, with an M1.3 flare observed at 25/1537UTC from AR3751. There are currently eleven sunspot regions on the solar disc. AR3751, which has been one of the most active regions, is close to the southwestern limb and has become difficult to view and analyse. Right next to it is AR3761, maintaining a slow decay. The largest and most complex region, AR3762, is now crossing the central meridian into the southwest quadrant. This region continues to display a tenuous delta spot within its intermediate spots, although the delta spot in its trailing portion has now separated as the trailing portion shows sign of decay. AR3767 was numbered in the southeast, close to AR3765 and AR3766. All other remaining regions also appear small, simple.

A partial halo CME was observed shortly after 25/0025 UTC on Coronagraph and Stereo imagery. While dimming was observed originating from AR3762 near the centre disc, the timing doesn't match (the halo appearing slightly before the dimming), which suggests that this CME is most likely far-sided. The spectrometer onboard Solar Orbiter also recorded an estimated X7 at 24/2325 UTC, likely reinforcing the idea of a far-sided event. No Earth-directed CMEs have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by ACE at L1, was at background levels initially, before the unexpected arrival of a CME around 25/1330 UTC, leading to a sudden rise in solar wind speeds to slightly elevated levels, peaking near 470km/s at 25/1445 UTC. Despite the arrival of a CME, density remained below average throughout. The Interplanetary magnetic field (IMF), Bt, was Moderate, at around 10nT, but increased to become strong, with a peak of 16nT at 25/2100UTC, due to the CME arrival. The north-south component, Bz, was weak initially, but increased to become moderate or strongly negative (southward) from 25/1330UTC as the CME arrived at L1, with a peak of -14nT at 25/2110 UTC. The phi angle varied between negative and positive, but became predominately positive (away from the Sun) after 25/1300 UTC. The net result of the above solar wind measures was for mostly Quiet (Kp1-2) conditions, with Unsettled (Kp3) intervals observed 25/0900-1200UTC and 25/1800-2100 UTC.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 has returned back to background levels after a period above S1 on 23 Jul following a large far sided full halo CME. High energy electron flux (greater than 2MeV) observed at GOES16 was at Normal Background. The 24-hour fluence was well below Active, with 1.06e6 integrated pfu observed at 26/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is expected, with a chance of further M-class flares.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Solar Wind /Geomagnetic Activity: No coronal hole fast winds feature in the forecast period. An unexpected CME arrived at Earth on 25 Jul, although the source of this CME is currently unknown. The effects of this CME should begin to wane early on day 1 (26 Jul). Another CME may give Earth a glancing blow late on Day 1 or perhaps early on Day 2 (26/27 July), originating from a long period M2.4 flare close to the southeast limb on 23 Jul. Confidence is low though.

Geomagnetic activity is expected to be mostly Quiet to Unsettled initially, with a slight chance of Active intervals early day 1 (Jul 26) due to the effects of the unexpected CME arrival on 25 Jul. Activity is likely to increase late Day 1 (Jul 26) or early Day 2 (27 Jul) to become Unsettled or Active, with a Slight Chance of G1/Minor Storm due to possible glancing CME. Activity wanes on Day 3 (28 Jul) with conditions becoming mostly Quiet by Day 4 (29 Jul).

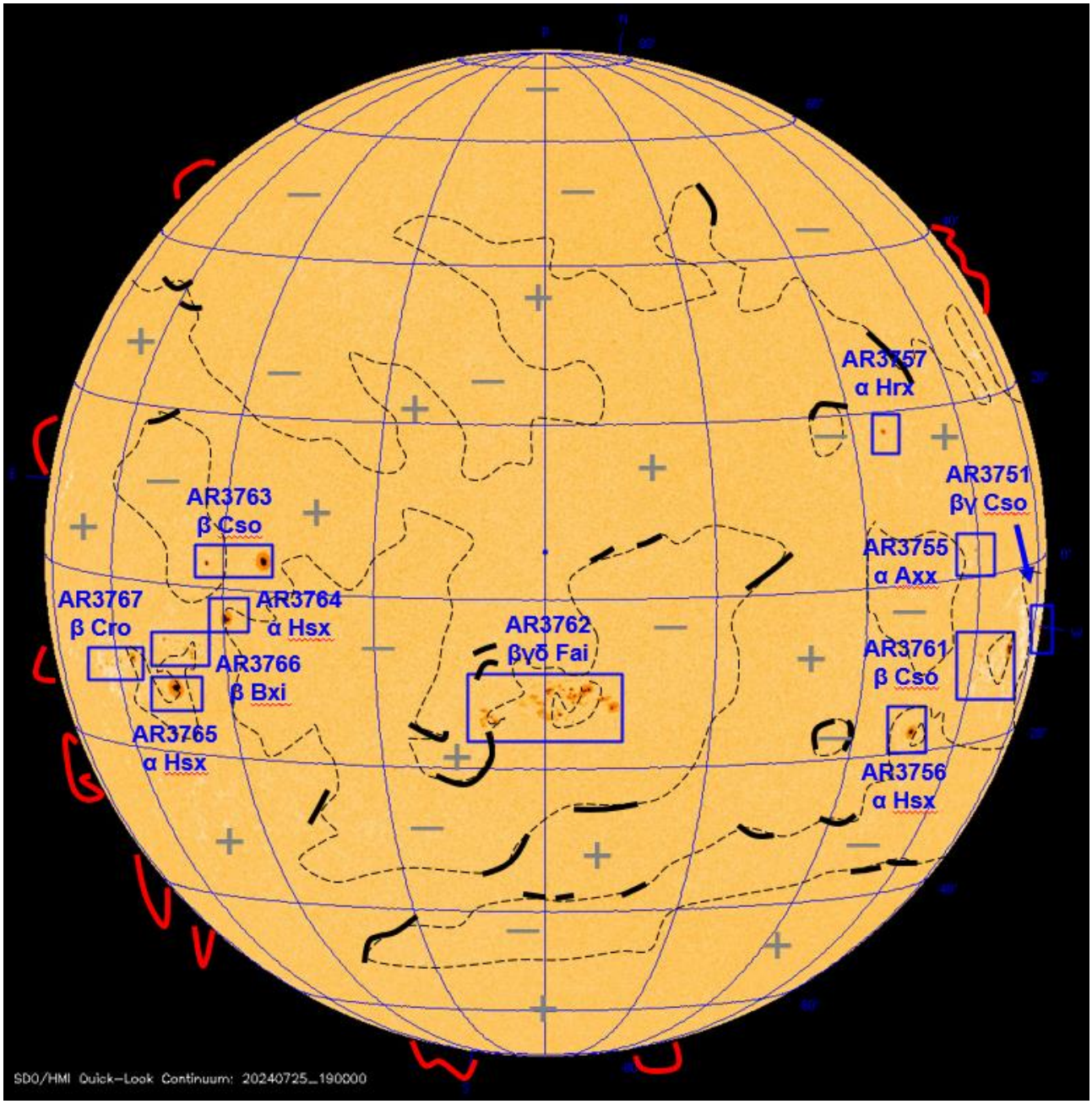
Energetic Particles / Solar Radiation: High energy proton levels are likely to remain at background levels, although there is a slight chance of reaching the S1 threshold if any notable flares occur throughout the remainder of the period.

The high energy electron flux is expected to persist at normal background levels, given no notable changing events have occurred recently or are expected. Electron fluence levels are therefore expected to remain below the Active (1e8 pfu) threshold.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 1. Solar Analysis Valid 25/1900 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Geomagnetic Storms:

No coronal hole fast winds feature in the forecast period. The 21 July CME should have arrived and has now been dismissed. It's not very clear as to what happened to it but two possibilities have been considered. This CME was perhaps far-sided or it caught up with an earlier and much slower one (19 July CME), along with a very slow background solar wind environment (~250 km/s), hence greatly reducing its arrival speed at Earth, as observed around 23/1948 UTC.
However, an unexpected CME did arrive at Earth at around 25/1300 UTC, although the source of this CME is currently unknown. However, solar winds increased to slightly elevated levels, becoming steady at near 400km/s. No significant geomagnetic response so far, although currently at Unsettled conditions, with perhaps the Chance of Active (Kp4), if any prolonged negative Bz (southward) early Day 1 (26 Jul). Low confidence.

Another CME may give Earth a glancing blow. It originated from a long period M2.4 flare close to the southeast limb near AR3764 at 23/1430 UTC. This gave a wide and moderately fast CME, perhaps with low confidence of peripheral glancing impacts at Earth possible either late on Day 1 or early Day 2 (26/27 Jul). Geomagnetic activity is expected to be mostly Quiet with a chance of Unsettled and Active intervals on Day 1 or early Day 2 (26/27 July) and a slight chance of G1/Minor storms. Any CME effects waning on Day 3 (28 Jul), with activity becoming mostly Quiet.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	30	20	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

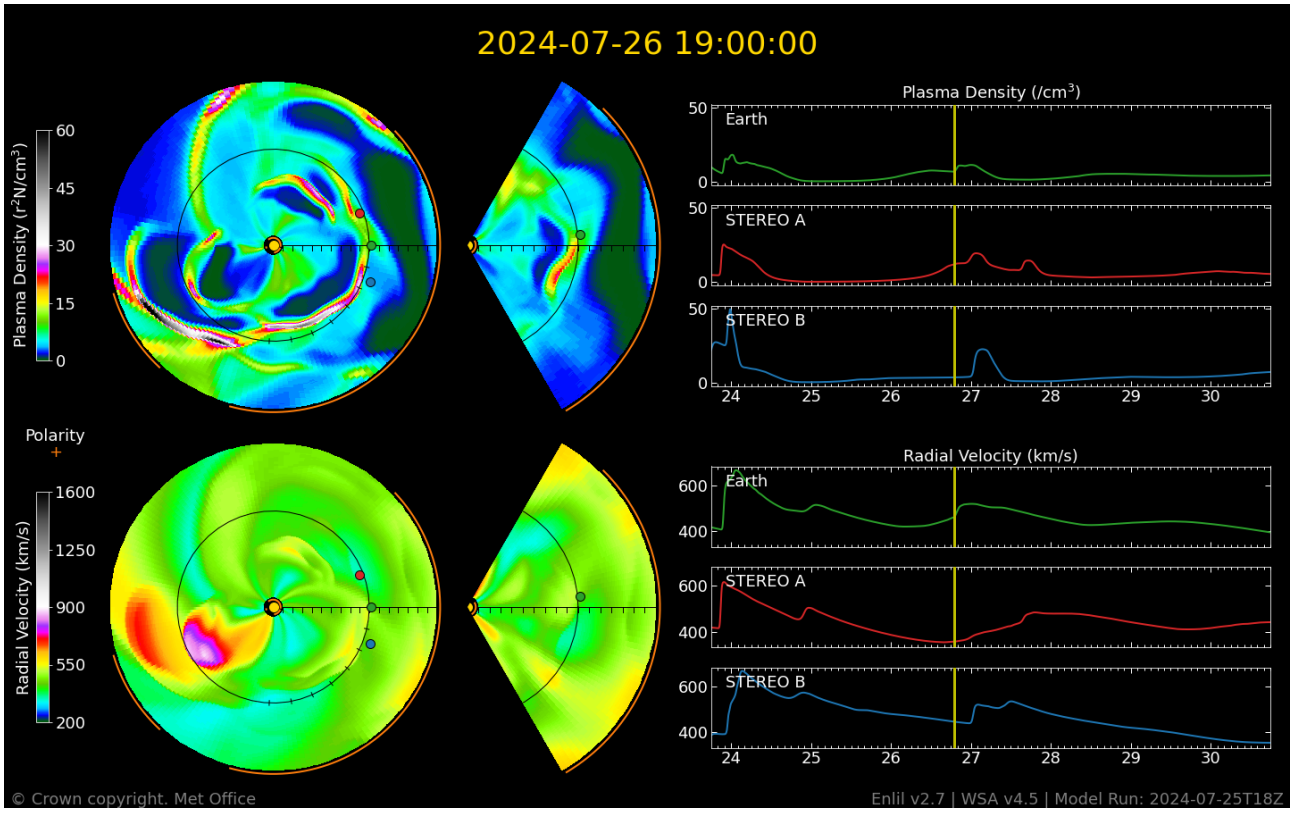
Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
23/2224	Partial	Filament Eruption	SE	560 m/s	26/1500 UTC +/- 12 hrs	Low confidence due to location

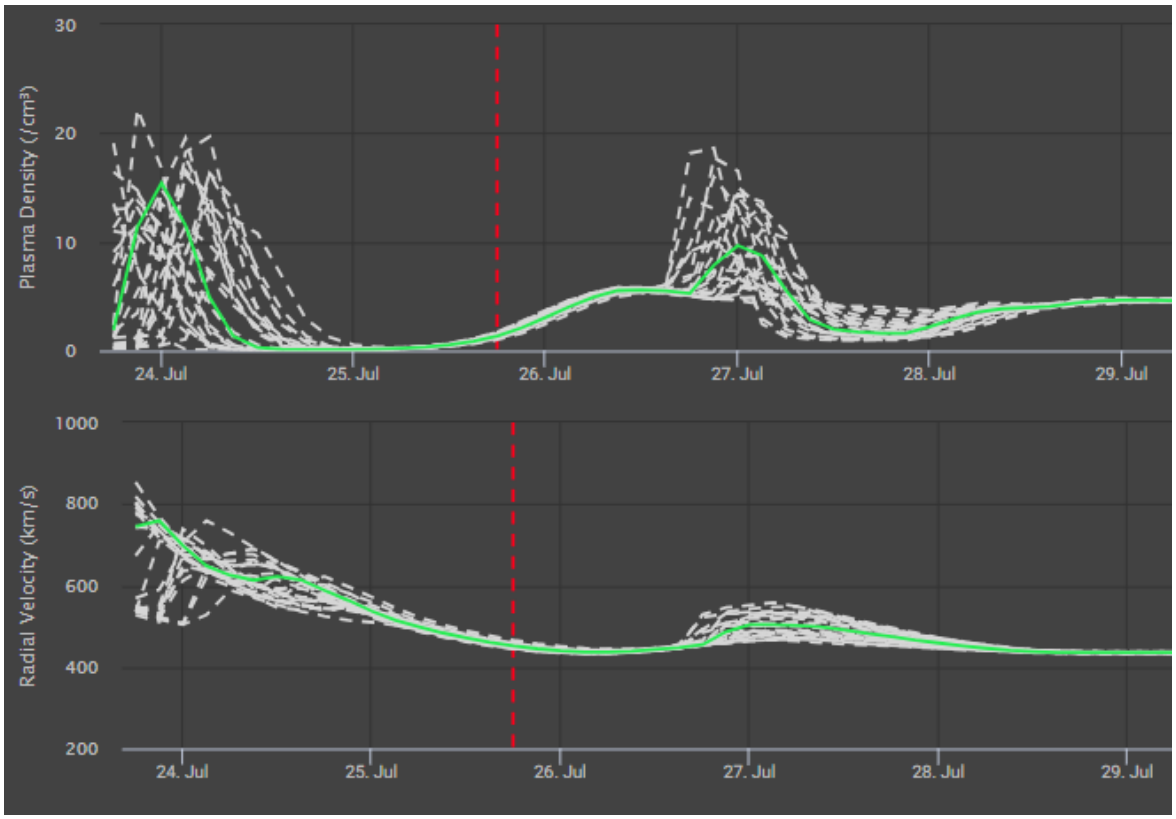
Figure 2: MOSWOC Enlil and Ensemble showing a possible glancing blow CME late 26 July or early on 27 July.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Space Weather Technical Forecast





Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

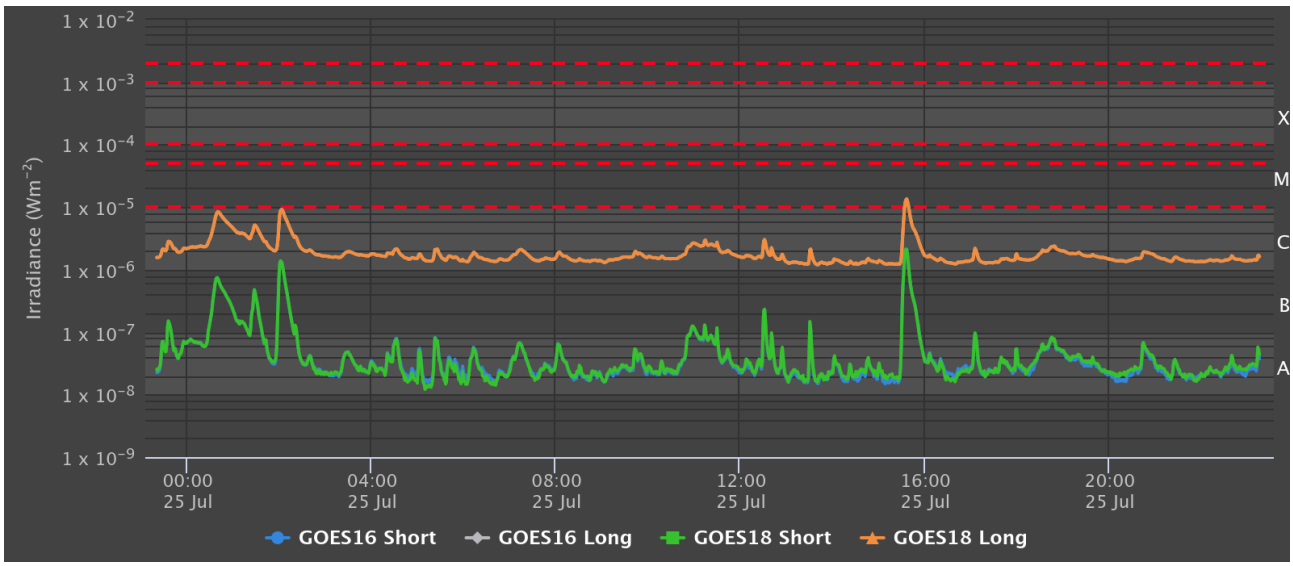
© Crown Copyright 2024. All Rights Reserved.

Radio Blackouts - X-Ray Flares:
Activity has been Moderate with an M1.3 flare observed at 25/1537 UTC from AR3751.

There are currently eleven sunspot regions on the solar disc. AR3751, which has been one of the most active regions, is close to the southwestern limb and has become difficult to view and analyse. Right next to it is AR3761, maintaining a slow decay. The largest and most complex region, AR3762, is now crossing the central meridian into the southwest quadrant. This region continues to display a tenuous delta spot within its intermediate spots, although the delta spot in its trailing portion has now separated as the trailing portion shows sign of decay. AR3767 was numbered in the southeast, close to AR3765 and AR3766, although appears to be small and simple. All other remaining regions also appear small, simple and/or largely unchanged.
Activity is expected to be Low to Moderate with a chance of further M-class flares.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	50	50	50	50
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: GOES-18 X-Ray Flux trace.



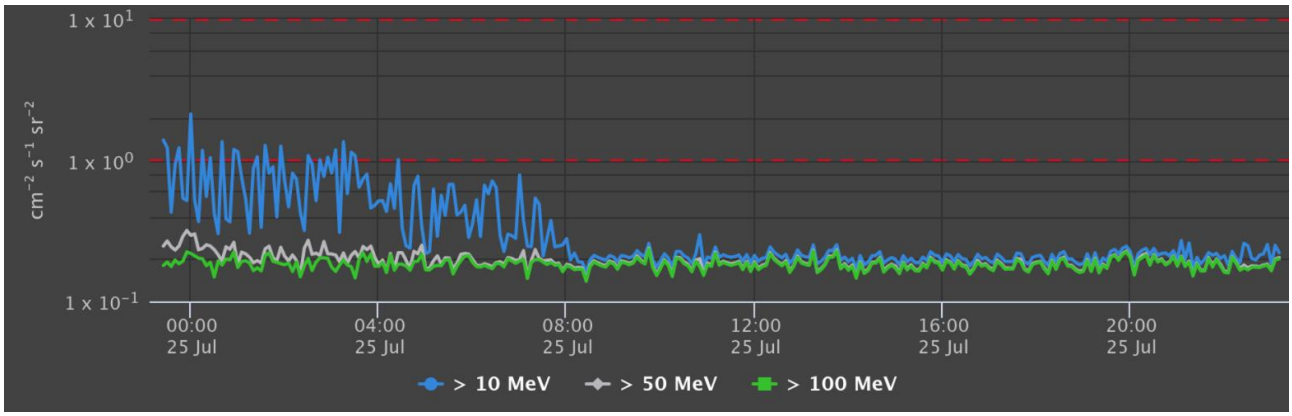
Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):
Proton levels have returned back to background levels. High energy proton levels are likely to remain at background levels, although there is a slight risk of reaching the S1 threshold if any notable flares occur throughout the remainder of the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: Latest GOES16 Proton Flux



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

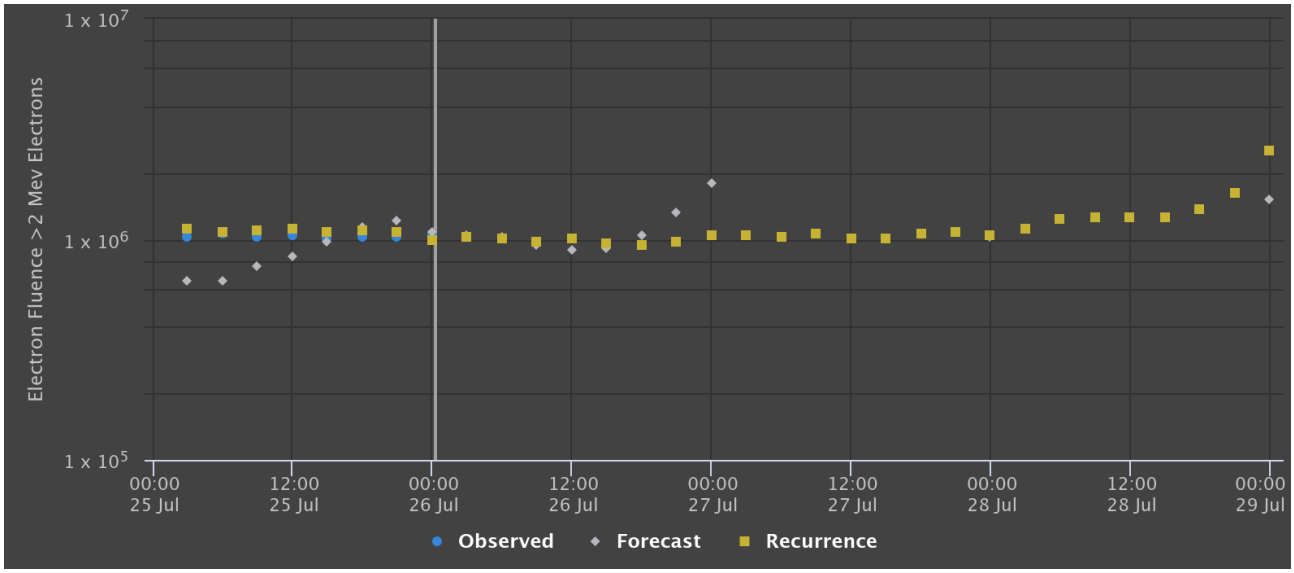
© Crown Copyright 2024. All Rights Reserved.

High Energy Electrons Event (≥ 2MeV):
The high energy electron flux as observed by GOES-16 is currently at background. Given the lack of any notable fast wind and any CME influence on Day 1 or 2 (26/27 July) expected to be relatively limited, background flux is forecast to persist.

The associated electron fluence is expected to persist below the Active level with MOSWOC REFM currently providing good guidance.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	1	1
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 5: MOSWOC REFM Electron Fluence



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.